

Claims:

- 1 1. A method of performing an incision on a skin surface using a computer aided  
2 surgical navigation system, the system comprising: a sensor adapted to sense the  
3 position and orientation of at least one surgical reference associated with a structure  
4 to be referenced; and computer functionality adapted to receive information from the  
5 sensor about position and orientation of the surgical reference and generate  
6 information corresponding to the position and orientation of the structure to be  
7 referenced to which the surgical reference is associated, the method of guiding the  
8 surgical incision comprising:
  - 9 (a) associating at least one first surgical reference with a portion of an  
10 individual's bony anatomy and skin proximate the bony anatomy;
  - 11 (b) registering the position and orientation of the portion of the individual's  
12 bony anatomy and skin proximate the bony anatomy with the computer aided  
13 surgical navigation system such that the computer functionality can generate  
14 information corresponding to the position and orientation of the individual's bony  
15 anatomy and skin proximate the bony anatomy by receiving information from the  
16 sensor sensing the position and orientation of the first surgical reference;
  - 17 (c) calculating a suggested incision path and length based upon the  
18 information generated by the computer functionality corresponding to the position  
19 and orientation of the individual's bony anatomy and skin proximate the bony  
20 anatomy;
  - 21 (d) associating at least one second surgical reference with an incision  
22 device, wherein the incision device is a cutting device or a marking device;
  - 23 (e) registering the position of the incision device with the computer aided  
24 surgical navigation system such that the computer functionality can generate  
25 information corresponding to the position of the incision device by receiving  
26 information from the sensor sensing the position and orientation of the second  
27 surgical reference; and

28 (f) using the incision device in the performance of the incision, wherein the  
29 computer aided surgical navigation system provides guidance based on comparing  
30 the suggested incision path and length with the information corresponding to the  
31 position and orientation of the incision device as generated by the computer  
32 functionality by receiving information from the sensor sensing the position and  
33 orientation of the second surgical reference.

1 2. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 1, wherein the computer aided surgical  
3 navigation system providing guidance further comprises a display associated with  
4 the computer aided surgical navigation system displaying the suggested incision  
5 path and length and the position of the incision device.

1 3. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 2, wherein displaying the suggested  
3 incision path and length and the position of the incision device further comprises a  
4 semi-transparent display displaying the suggested incision path and length and the  
5 position of the of the incision device or a monitor displaying the suggested incision  
6 path and length and the position of the of the incision device.

1 4. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 1, further comprising providing feedback if  
3 the incision device deviates from the suggested incision.

1 5. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 4, wherein providing feedback comprises  
3 providing a visible warning if the incision deviates from the suggested incision.

1 6. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 5, wherein providing a visible warning if

3 the incision deviates from the suggested incision comprises displaying a comparison  
4 of the suggested incision path and length with at least a portion of a path traveled by  
5 the incision device.

1 7. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 5, further comprising projecting an image  
3 of the suggested incision onto the individual; and wherein providing a visible warning  
4 if the incision deviates from the suggested incision comprises altering the image if  
5 the incision deviates from the suggested incision.

1 8. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 4, wherein providing feedback further  
3 comprises providing an audible warning if the incision deviates from the suggested  
4 incision path.

1 9. The method of performing an incision on a skin surface using a computer  
2 aided surgical navigation system of Claim 1, further comprising: using the incision to  
3 access the interior of the individual to install an orthopaedic implant; and installing  
4 the orthopaedic implant.

1 10. A system for guiding an incision on a skin surface, comprising:  
2 (a) a computer aided surgical navigation system, comprising:  
3 (i) a sensor adapted to sense the position and orientation of at least  
4 one surgical reference associated with a structure to be referenced; and  
5 (ii) computer functionality adapted to receive information from the  
6 sensor about position and orientation of the surgical reference and generate  
7 information corresponding to the position and orientation of the structure to be  
8 referenced to which the surgical reference is associated;  
9 (b) at least one first surgical reference adapted to be associated with a  
10 portion of an individual's bony anatomy and skin proximate the bony anatomy such

11 that the position and orientation of the portion of the individual's bony anatomy and  
12 skin proximate the bony anatomy can be registered with the computer aided surgical  
13 navigation system, the computer functionality adapted to generate information  
14 corresponding to the position and orientation of the individual's bony anatomy and  
15 skin proximate the bony anatomy by receiving information from the sensor sensing  
16 the position and orientation of the first surgical reference, the computer functionality  
17 adapted to calculate a suggested incision path and length on the skin proximate the  
18 bony anatomy based upon the information generated by the computer functionality  
19 corresponding to the position and orientation of the individual's bony anatomy;

20 (c) at least one second surgical reference adapted to be associated with  
21 an incision device, wherein the incision device is a cutting device or a marking  
22 device, the at least one second surgical reference adapted to be registered with the  
23 computer aided surgical navigation system, the computer functionality adapted to  
24 generate information corresponding to the position of the incision device by  
25 receiving information from the sensor sensing the position and orientation of the  
26 second surgical reference; and

27 (d) wherein the computer aided surgical navigation system is adapted to  
28 compare the suggested incision path and length with the information corresponding  
29 to the position of the incision device.

1 11. The system for guiding an incision on a skin surface of Claim 10, further  
2 comprising a display, the display adapted to compare the suggested incision path  
3 and length with the information concerning the position of the incision device by  
4 displaying the suggested incision path and length and the position of the incision  
5 device.

1 12. The system for guiding an incision on a skin surface of Claim 11, wherein the  
2 display comprises a semi-transparent display or a monitor.

1 13. The system for guiding an incision on a skin surface of Claim 12, wherein the  
2 display comprises a semi-transparent display, the semi-transparent display  
3 associated with at least one third surgical reference, the at least one third surgical  
4 reference adapted to be registered with the computer aided surgical navigation  
5 system, the computer functionality adapted to generate information corresponding to  
6 the position and orientation of the semi-transparent display by receiving information  
7 from the sensor sensing the position and orientation of the third surgical reference.

1 14. The system for guiding an incision on a skin surface of Claim 10, wherein the  
2 computer aided surgical navigation system further comprises feedback functionality  
3 adapted to provide feedback if the incision device deviates from the suggested  
4 incision path.

1 15. The system for guiding an incision on a skin surface of Claim 14, wherein the  
2 feedback functionality is adapted to provide visual feedback if the incision device  
3 deviates from the suggested incision path.

1 16. The system for guiding an incision on a skin surface of Claim 15, wherein the  
2 feedback functionality comprises a display adapted to display the suggested incision  
3 and a path traveled by the incision device.

1 17. The system for guiding an incision on a skin surface of Claim 15, further  
2 comprising a projector, the projector: adapted to project an image of the suggested  
3 incision path onto the individual; and adapted to provide visual feedback if the  
4 incision device deviates from the suggested incision path by altering the image if the  
5 incision device deviates from the suggested incision path.

1 18. The system for guiding an incision on a skin surface of Claim 15, wherein the  
2 feedback functionality is adapted to provide audible feedback if the incision device  
3 deviates from the suggested incision path.

1       19. A system for guiding an incision on a skin surface, comprising:

2           (a) a computer aided surgical navigation system, comprising:

3               (i) a sensor adapted to sense the position and orientation of at least

4       one surgical reference associated with a structure to be referenced; and

5               (ii) computer functionality adapted to receive information from the

6       sensor about position and orientation of the surgical reference and generate

7       information corresponding to the position and orientation of the structure to be

8       referenced to which the surgical reference is associated;

9           (b) at least one first surgical reference adapted to be associated with a

10      portion of an individual's bony anatomy and skin proximate the bony anatomy such

11      that the position and orientation of the portion of the individual's bony anatomy and

12      skin proximate the bony anatomy can be registered with the computer functionality,

13      the computer functionality adapted to generate information corresponding to the

14      position and orientation of the individual's bony anatomy and skin proximate the

15      bony anatomy by receiving information from the sensor sensing the position and

16      orientation of the first surgical reference, the computer functionality adapted to

17      calculate a suggested incision path and length based upon the information

18      generated by the computer functionality corresponding to the position and

19      orientation of the individual's bony anatomy and skin proximate the bony anatomy;

20           (c) at least one second surgical reference adapted to be associated with

21      an incision device, wherein the incision device is a cutting device or a marking

22      device, the at least one second surgical reference and the incision device adapted to

23      be registered with the computer aided surgical navigation system, the computer

24      functionality adapted to generate information corresponding to the position of the

25      incision device by receiving information from the sensor sensing the position and

26      orientation of the second surgical reference;

27           (d) wherein the computer aided surgical navigation system is adapted to

28      compare the suggested incision with the information corresponding to the position of

29      the incision device; and

30 (e) wherein the computer aided surgical navigation system further  
31 comprises feedback functionality adapted to provide feedback if the incision device  
32 deviates from the suggested incision.

1 20. The system for guiding an incision on a skin surface of Claim 19, further  
2 comprising a projector, the projector adapted to project an image of the suggested  
3 incision path onto the individual and adapted to provide visual feedback by altering  
4 the image if the incision device deviates from the suggested incision path.

1 21. The system for guiding an incision on a skin surface of Claim 19, further  
2 comprising a display, the display adapted to display an image of the suggested  
3 incision path and display at least a portion of a path followed by the incision device.

- 1 22. A system for guiding an incision on a skin surface, comprising:
  - 2 (a) a computer aided surgical navigation system, comprising:
    - 3 (i) a sensor adapted to sense the position and orientation of at least
    - 4 one surgical reference associated with a structure to be referenced; and
    - 5 (ii) computer functionality adapted to receive information from the
    - 6 sensor about position and orientation of the surgical reference and generate
    - 7 information corresponding to the position and orientation of the structure to be
    - 8 referenced to which the surgical reference is associated;

9 (b) at least one first surgical reference adapted to be associated with a  
10 portion of an individual's bony anatomy and skin proximate the bony anatomy such  
11 that the position and orientation of the portion of the individual's bony anatomy and  
12 skin proximate the bony anatomy can be registered with the computer functionality ,  
13 the computer functionality adapted to generate information corresponding to the  
14 position and orientation of the individual's bony anatomy and skin proximate the  
15 bony anatomy by receiving information from the sensor sensing the position and  
16 orientation of the first surgical reference, the computer functionality adapted to  
17 calculate a suggested incision path and length based upon the information

18 generated by the computer functionality corresponding to the position and  
19 orientation of the individual's bony anatomy and skin proximate the bony anatomy;  
20 (c) at least one second surgical reference adapted to be associated with  
21 an indicator device, the at least one second surgical reference and indicator device  
22 adapted to be registered with the computer aided surgical navigation system, the  
23 computer functionality adapted to generate information corresponding to the position  
24 of the indicator device by receiving information from the sensor sensing the position  
25 and orientation of the second surgical reference; and  
26 (d) wherein the computer aided surgical navigation system assists the  
27 indicator device in outputting the suggested incision path and length onto the skin  
28 surface based upon the information corresponding to the position of the indicator  
29 device and the information corresponding to the position and orientation of the  
30 individual's bony anatomy and skin proximate the bony anatomy.

1 23. The system for guiding an incision on a skin surface of Claim 22, wherein the  
2 indicator device comprises a marking device.

1 24. The system for guiding an incision on a skin surface of Claim 22, wherein the  
2 indicator device comprises a projector adapted to project an image of the suggested  
3 incision path onto the individual.